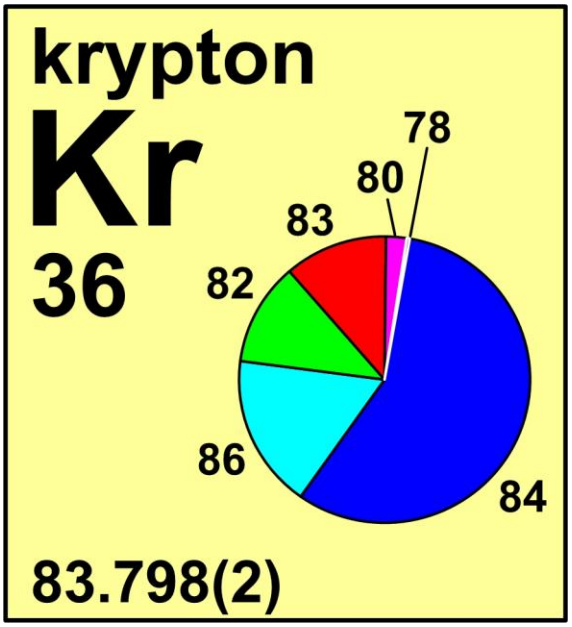
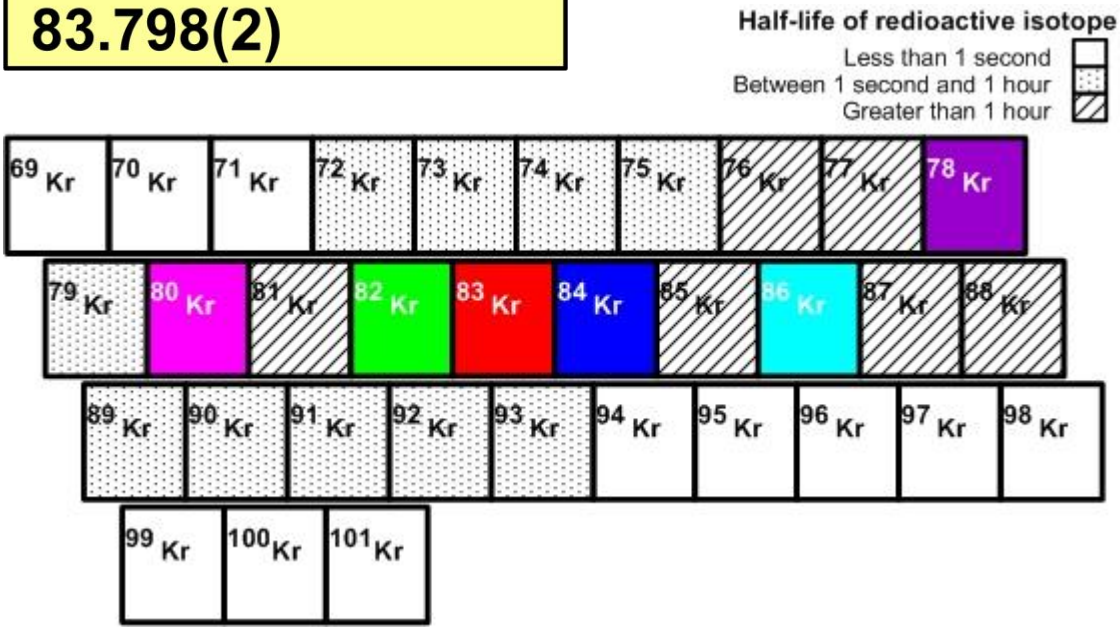
krypton



Stable isotope	Atomic mass*	Mole fraction
^{78}Kr	77.920 3648	0.003 55
^{80}Kr	79.916 379	0.022 86
^{82}Kr	81.913 4836	0.115 93
^{83}Kr	82.914 136	0.115 00
^{84}Kr	83.911 507	0.569 87
^{86}Kr	85.910 610 73	0.172 79

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

1) ^{85}Kr can be inhaled as a gas so that it is absorbed in the bloodstream of a patient, which allows for the flow of blood in the patient to be studied. The path the krypton takes can be followed by holding a detection device over the patient's body, which gives a visual of the radioactive materials path and how fast it is moving.

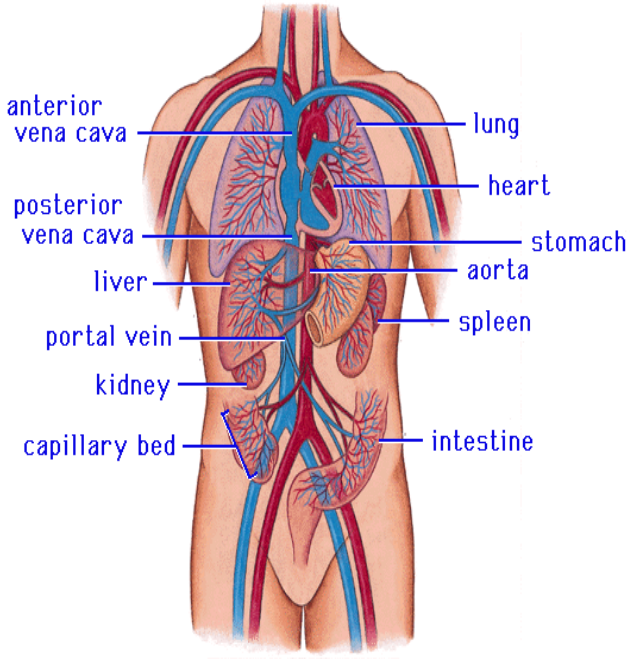


Figure 1: This is a picture of the human circulatory system. ^{85}Kr gas can be inhaled so that it can be absorbed in the bloodstream, which allows for the pathway that the blood takes to get to the heart to be traced.

Isotopes in the environment

1) ^{85}Kr can also be used in atmospheric monitoring to track the effect atomic facilities may have on the surrounding environment.
    a. When ^{85}Kr is monitored at short distances (i.e. 1-5km) from the area of clandestine separation of plutonium, which is co-generated with plutonium in the fuel elements of nuclear fission reactors, differences in ^{85}Kr levels in the atmosphere can be used to predict the amount of plutonium separated at weekly intervals. The production of plutonium for nuclear weapons purposes and the commercial reprocessing plants have released large amounts of ^{85}Kr in the atmosphere.

Isotopes in tracer studies

1) ^{85}Kr enters ground water through equilibration of the water with air before the water moves into the ground. During this exposure of water to the atmosphere, it is assumed that ^{85}Kr levels are similar in both. The ^{85}Kr specific activity of groundwater can be used to define the time since the infiltration water was isolated from the atmosphere. ^{85}Kr minimal natural production in the earth and its increasing concentrations in the atmosphere verifies that groundwater is older than the year 1950 and makes ^{85}Kr a potential replacement for ^{3}H dating since tritium levels continue to decline.
2) ^{81}Kr radioactive half-life of 250,000 years makes it useful to age old groundwater of 50,000 to 800,000 years.
3) Naturally occurring isotopes of krypton (^{78}Kr, ^{80}Kr, ^{82}Kr, ^{83}Kr, ^{84}Kr, ^{86}Kr) react with the upper atmosphere by cosmic ray induced spallation and neutron activation to produce ^{81}Kr.

4) In the atmosphere, ^{81}Kr has a long lifetime as well as chemical inertness and because of these characteristics, it is expected that ^{81}Kr has a constant and well constrained atmospheric source through negligible subsurface sources or sinks.

Isotopes in industry

1) ^{85}Kr can be used as the illumination element of indicator lights of appliances.
2) ^{85}Kr is a radioactive isotope that can be combined with phosphors to produce materials that shine in the dark. Radiation given off by ^{85}Kr strikes the phosphor and the phosphor then gives off light.
3) ^{85}Kr can be used to detect container leaks by placing the radioactive gas inside a container and measuring the amount of radioactive ^{85}Kr that escapes with a radiation detecting device. Because the gas is inert, krypton will not react with anything else in the container.

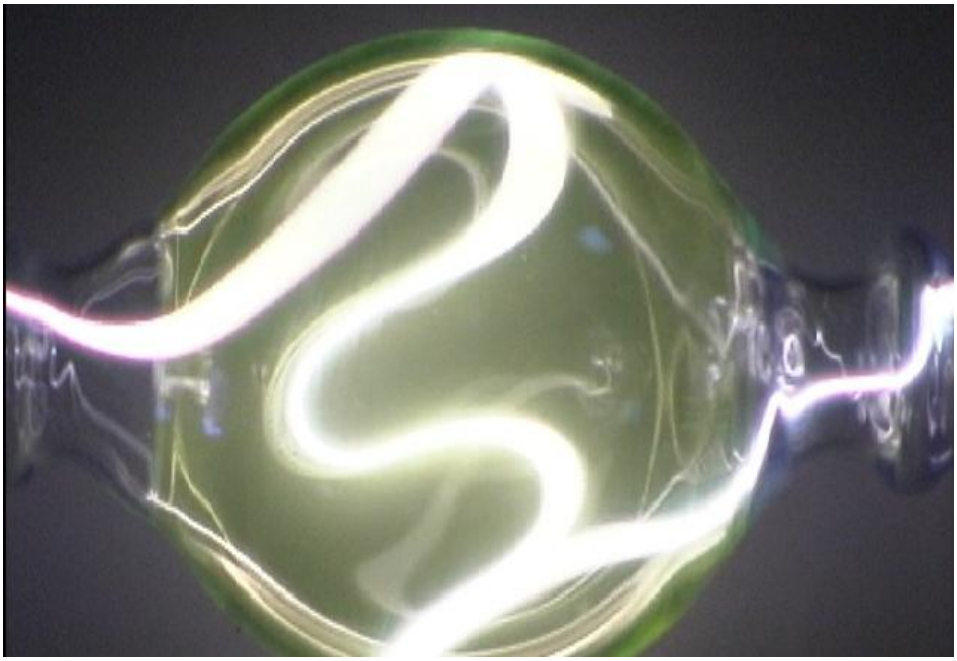


Figure 2: This is a picture of a light bulb that contains krypton gas.